

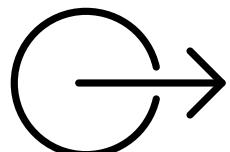


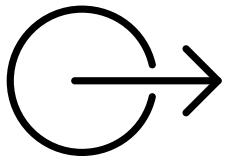
A Hybrid Investment Strategy

Campus Challenge: Successful Investing
with AI and Large Language Models

Technical University of Munich

Presentation by
Batuhan Ayverdi & Hamide Nur Tutuk





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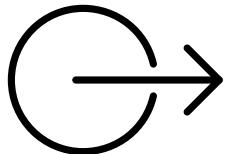


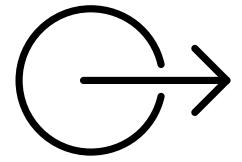
- 01.** Introduction
- 02.** First Investment Period
- 03.** Tracking & Adjustments
- 04.** Sentiment Analysis
- 05.** Performance Review

1. Introduction

Why Machine Learning in Investing?

- **Traditional Investing:** human intuition & historical trends
- **ML:** data-driven decisions, reduced biases
- Random Forest detects hidden patterns
- AI strategies outperform traditional models (Gu et al., 2020)
- Tree-based models handle market **non-linearity**





1. Introduction

Why S&P 500?

Coverage

Represents ~80% of the U.S. economy with 500 large-cap stocks.

Liquidity

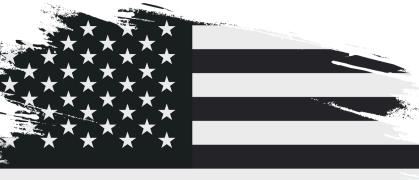
High liquidity reduces transaction costs and improves trade efficiency.

Research

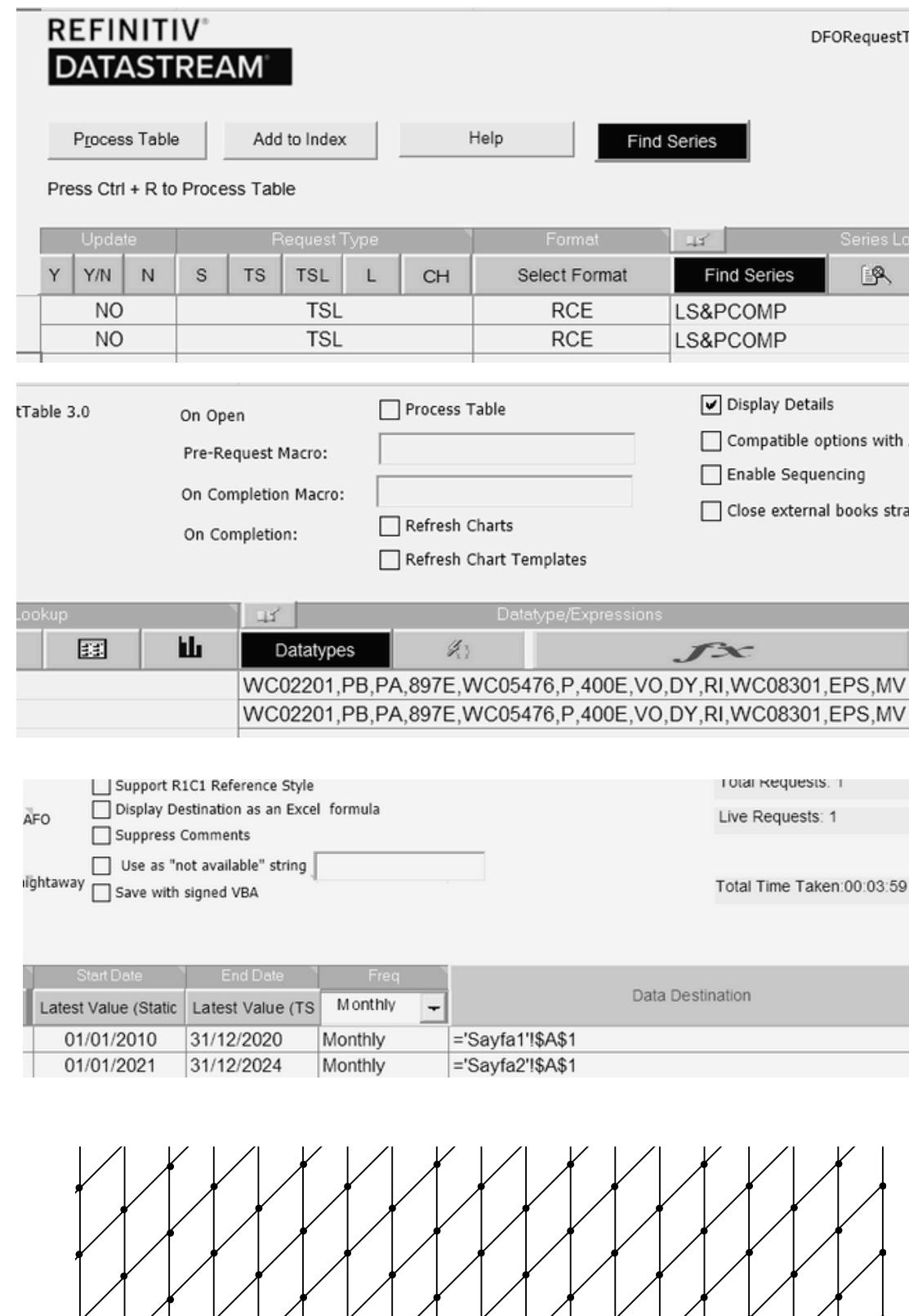
Frequently used in academic studies for ML-based investment validation.

Data Quality

Lower missing data issues in Refinitiv compared to broader indices.



2. First Investment Period



Choosing the Right Features

- Price Return Index as the **dependent variable** for stock return prediction.
- Selected features balance liquidity, risk, valuation, profitability.
- Literature-based selection (Kaczmarek & Perez, 2022) ensures predictive relevance.

01. Liquidity

- Bid-Ask Spread (Amihud & Mendelson).
- Turnover by Volume (Chordia, Subrahmanyam, & Anshuman).

02. Valuation

- Market Value (Banz).
- Book-to-Market Ratio (Rosenberg, Red, & Lanstein).
- Earnings Per Share (Basu).

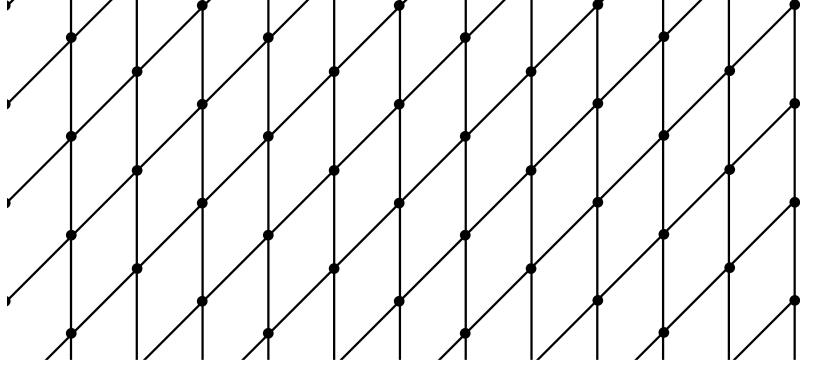
03. Risk

- Beta (Fama & MacBeth).
- Return Volatility (Ang, Hodrick, Xing, & Zhang).

04. Profitability

- Return on Equity (Hou, Xue, & Zhang).
- Dividend Yield (Litzenberger & Ramaswamy).

2. First Investment Period



Handling Data Challenges

- **Survivorship Bias** → Stocks entering/exiting the index distort performance analysis.
- **Filtered Dataset** → Retained only stocks existing in both **2010-2020 (train)** & **2021-2024 (test)**.
- **Missing Data** → Handled using a weighted average approach to preserve trends.
- **Standardization & Normalization** → Ensured data comparability across time.

```
for column in data.columns:  
    if data[column].isnull().any():  
        for index in reversed(data.index):  
            if pd.isnull(data.at[index, column]):  
                next_values = data[column][index:].dropna().head(12)  
  
                # Skip if there are no valid values  
                if len(next_values) == 0:  
                    continue  
  
                # Assign weights (higher weight for closer values)  
                next_weights = list(range(len(next_values), 0, -1))  
  
                weighted_avg = np.average(next_values, weights=next_weights)  
  
                # Fill the missing value with the weighted average  
                data.at[index, column] = weighted_avg
```

```
def preprocess_data(data):  
    timestamps = pd.to_datetime(data.iloc[2:, 0])  
    company_names = data.iloc[0, 1:].values  
    feature_names = data.iloc[1, 1:].values  
    values = data.iloc[2:, 1:].reset_index(drop=True)  
  
    multi_index = pd.MultiIndex.from_tuples(  
        list(zip(company_names, feature_names)), names=['Company', 'Feature'])  
    cleaned_data = pd.DataFrame(values.values, columns=multi_index)  
    cleaned_data.index = timestamps  
    return cleaned_data
```

2. First Investment Period

Random Forest for Stock Selection

Why Random Forest?

- Higher Sharpe Ratios & Risk-Adjusted Returns (Gu et al., 2020, cited in Kaczmarek & Perez, 2022).
- Handles non-linearity & feature interactions better than regression models.

Random Forest Model

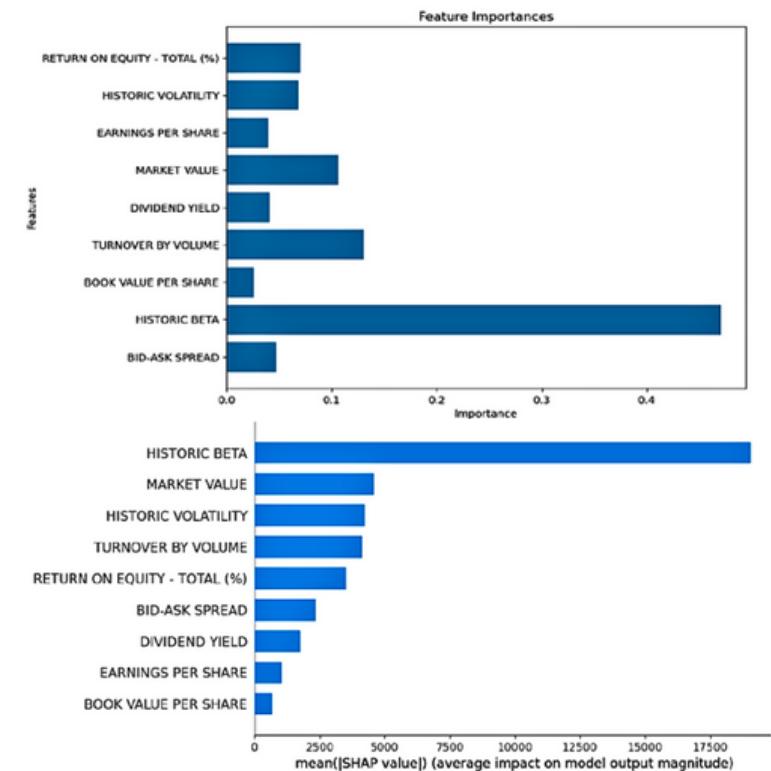
- Trained on historical stock data (liquidity, risk, valuation, profitability features).
- Trained on 2010-2020, tested on 2021-2024.

```
# Random Forest model training
rf_model = RandomForestRegressor(random_state=42, n_estimators=100, max_depth=10)
rf_model.fit(X_train, y_train)

# Predictions
y_pred_train = rf_model.predict(X_train)
y_pred_test = rf_model.predict(X_test)
```

Feature Importance

- Historic Beta (strongest predictor), Bid-Ask Spread (liquidity-sensitive pricing), Turnover by Volume (trading intensity).
- SHAP analysis validates key risk & liquidity factors.



Top 35 stocks selected for portfolio optimization.

Evaluation & Testing

- R² Score: -0.3586 (indicating noise in predictions)
- MAE: 79,872.59
- Top-ranked stocks consistently outperformed bottom-ranked ones.
- High variance in market behavior observed.

```
Test R^2 score: -0.3586
Test MAE: 79872.5868
```

```
Train Top 20 MAE: 149177.8077
Train Bottom 20 MAE: 9.8029
```

```
Test Top 20 MAE: 397202.5317
Test Bottom 20 MAE: 10823.7614
```

2. First Investment Period

Additional Checks

Refinitiv Sentiment Check

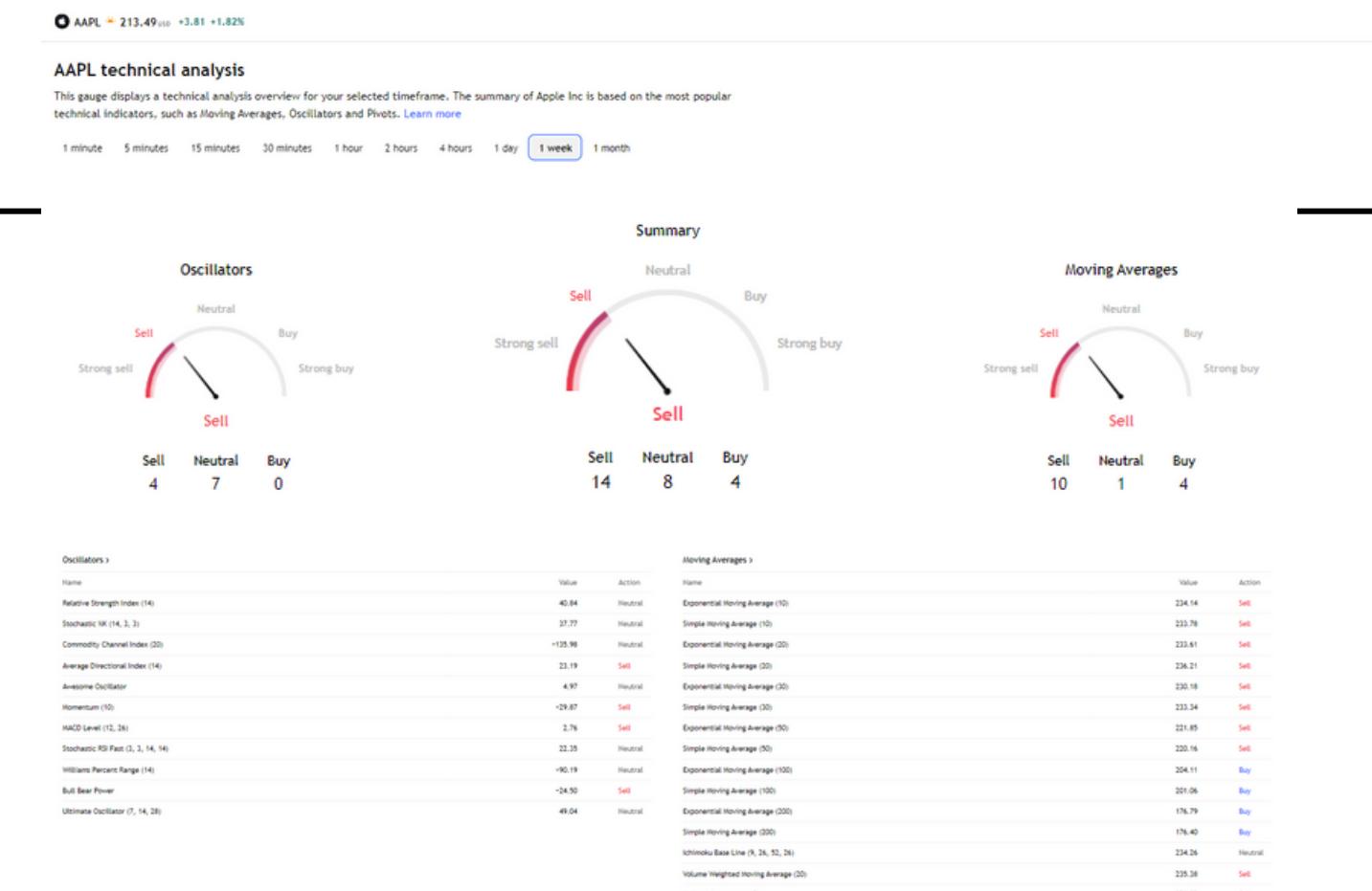
- Sentiment filtering ensured that only positively rated stocks remained in the portfolio.

Date & Time	Source	RICs	Headline	Sentiment
14 Mar 2025 01:00:26	© RTRS	AAPLO	UK, US Hold Private Talks In Bid To Calm Apple Encryption Feud - Bloomberg News [BRIEF]	⊕
10 Mar 2025 21:12:00	© RTRS	2317.TW 2354.TW AAPLO	iPhone-assembler Foxconn unveils first large language model [NEWSCASTS]	⊕
13 Mar 2025 23:06:08	© RTRS	.IXIC.SPLRCS .SPX	S&P 500 correction in six charts [GRAPHIC]	⊖
16 Mar 2025 01:00:00	© RTRS	.IXIC.SPLRCS .SPX	S&P 500 correction in six charts [RPT GRAPHIC]	⊖
12 Mar 2025 13:52:16	© RTRS	AAPLO.MTCH.O	Apple blocks Tinder owner, startups from commercial secrets in India antitrust case	⊖
17 Mar 2025 14:29:21	© RTRS	.DJI.INX.IXIC	Futures edge lower after treasury secretary's comments; eyes on upcoming Fed meet [US STOCKS]	⊖
11 Mar 2025 20:05:48	© RTRS	.SPX AAPLO DAL.N	Airline alarms are more dire than Big Tech buzz [BREAKINGVIEWS]	⊖
12 Mar 2025 15:00:00	© RTRS	.SPX AAPLO DAL.N	Airline alarms are more dire than Big Tech buzz [RPT BREAKINGVIEWS]	⊖
14 Mar 2025 23:15:48	© RTRS	.DJI.IGX.INX	A bright end to a bad week [LIVE MARKETS]	⊖
11 Mar 2025 18:20:02	© RTRS	.DJI.IXIC.MAG	Before and after: JOLTs vs NFIB [LIVE MARKETS]	⊖
14 Mar 2025 16:43:08	© RTRS	2317.TW AAPLO NVDA.O	Foxconn's Q4 profit drops 13% [CORRECTED]	⊖

Selected Stocks
w RF

Tradingview Decision Check

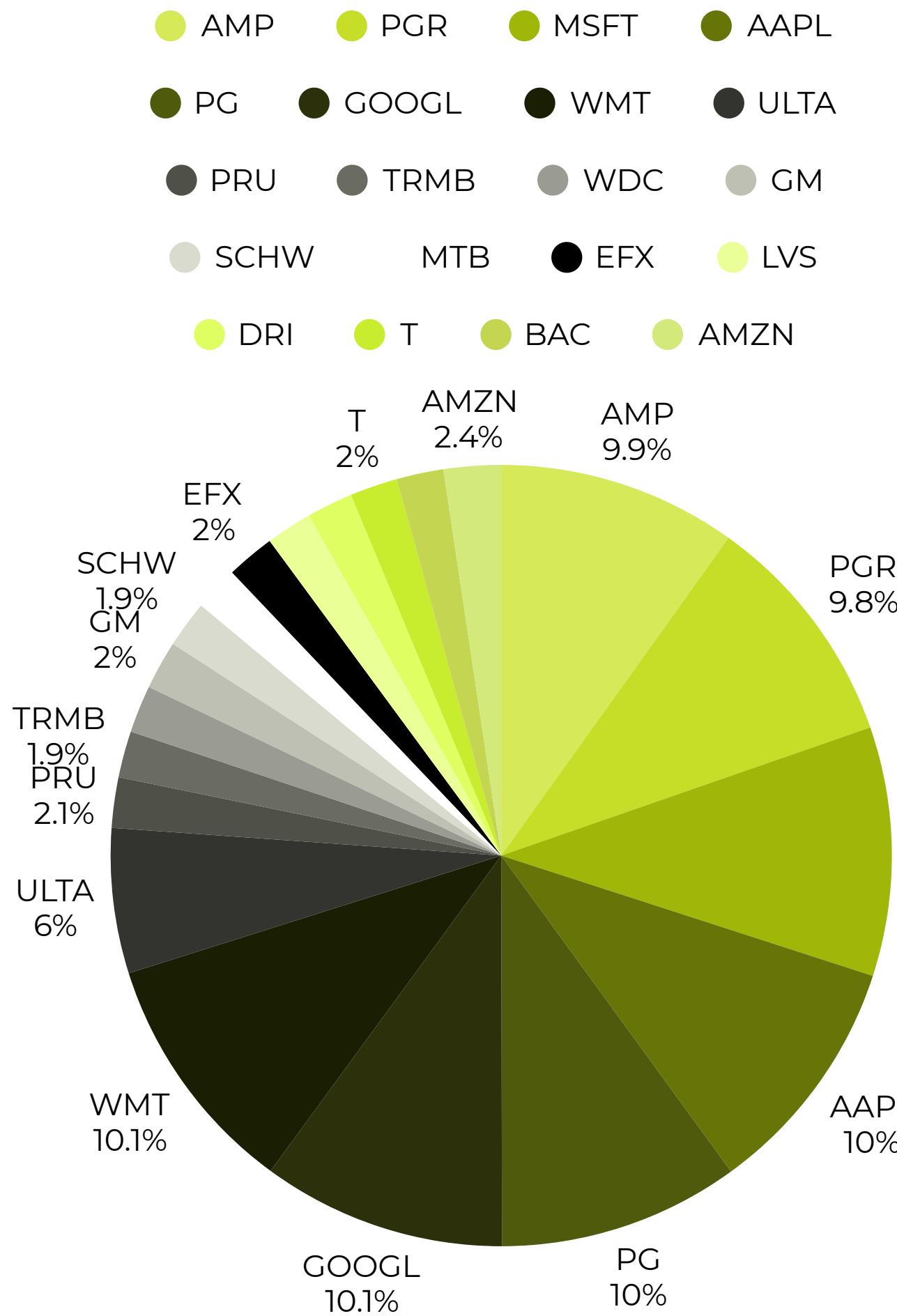
- TradingView was used to check buy/sell decisions using multiple technical indicators (RSI, Stochastic %K, MACD, Momentum, SMA, EMA, Ichimoku Cloud).



Final Stocks

2. First Investment Period

Markowitz Portfolio Optimization



- MVO optimizes risk-return tradeoff but is data-sensitive (Markowitz, 1952; Kaczmarek & Perez, 2022).
- Sharpe Ratio maximized by balancing return & risk.
- Stock allocation constraints: 2% – 10% per stock
- Annual returns & covariance matrix estimated from daily returns (252 trading days/year).
- Risk-free rate: 2% (Sharpe ratio calculation).
- \$100,000 investment budget used.

```
daily_returns = price_data.pct_change().dropna()
annual_returns = daily_returns.mean() * 252
cov_matrix = daily_returns.cov() * 252
risk_free_rate = 0.02
2 usages
def portfolio_metrics(weights, mean_returns, cov_matrix):
    portfolio_return = np.dot(weights, mean_returns)
    portfolio_volatility = np.sqrt(np.dot(weights.T, np.dot(cov_matrix, weights)))
    return portfolio_return, portfolio_volatility
1 usage
def negative_sharpe_ratio(weights, mean_returns, cov_matrix, risk_free_rate):
    p_return, p_volatility = portfolio_metrics(weights, mean_returns, cov_matrix)
    sharpe_ratio = (p_return - risk_free_rate) / p_volatility
    return -sharpe_ratio
1 usage
```

```
usage
def constraint_sum(weights):
    return np.sum(weights) - 1

# Başlangıç ağırlıkları
num_assets = len(price_data.columns)
initial_weights = np.ones(num_assets) / num_assets

constraints = ({'type': 'eq', 'fun': constraint_sum})
bounds = tuple((0.02, 0.10) for _ in range(num_assets))

optimal = minimize(negative_sharpe_ratio,
                   initial_weights,
                   args=(annual_returns, cov_matrix, risk_free_rate),
                   method='SLSQP',
                   bounds=bounds,
                   constraints=constraints)

optimal_weights = optimal.x
```

3. Tracking & Adjustments

The screenshot shows the Refinitiv Datastream software interface. At the top, there's a menu bar with 'REFINITIV' and 'DATASTREAM'. Below it are buttons for 'Process Table', 'Add to Index', 'Help', and 'Find Series'. A status message says 'Press Ctrl + R to Process Table'. There are three main sections: 1) A 'Request Type' table with columns for Update (Y/N), Request Type (S, TS, TSL, L, CH), Format (Select Format, Find Series), and Series Location (LS&PCOMP). It contains rows for 'YES TSL RCE LS&PCOMP' and 'YES TSL RCE LS&PCOMP'. 2) A 'Pre-Request Macro' section with fields for On Open, Pre-Request Macro, On Completion Macro, and On Completion. 3) A 'Datatype/Expressions' table with columns for Datatypes, Start Date, End Date, and Freq. It shows entries like 'PB,PA,897E,P,400E,RI, MV' with 'Latest Value (Static)' and 'Latest Value (TS)' both set to '01/01/2025' and 'Freq' set to 'Weekly'.

```
# RSI
def calculate_rsi(prices, window=14): 2 usages
    delta = prices.diff(1)
    gain = (delta.where(delta > 0, 0)).rolling(window=window).mean()
    loss = (-delta.where(delta < 0, 0)).rolling(window=window).mean()
    rs = gain / loss
    rsi = 100 - (100 / (1 + rs))
    return rsi

# Momentum
def calculate_momentum(prices, window=10): 2 usages
    return prices.diff(window)
```

Updating Features for Shorter Predictions

- **Transition from Monthly to Weekly Data** – Improved responsiveness and reduced lag in market signals.
- **Replacing Long-Term Indicators** – Removed Book-to-Market Ratio, added RSI & Momentum for short-term trend prediction.
- **Dynamic Feature Selection & Model Updates** – Weekly retraining of the Random Forest model for optimized predictive performance.

01. Liquidity

- Bid-Ask Spread (Amihud & Mendelson).
- Turnover by Volume (Chordia, Subrahmanyam, & Anshuman).

02. Valuation

- Market Value (Banz).
- ~~Book-to-Market Ratio (Rosenberg, Red, & Lanstein)~~.
- ~~Earnings Per Share (Basu)~~.

03. Risk

- Beta (Fama & MacBeth).
- Return Volatility (Ang, Hodrick, Xing, & Zhang).

04. Profitability

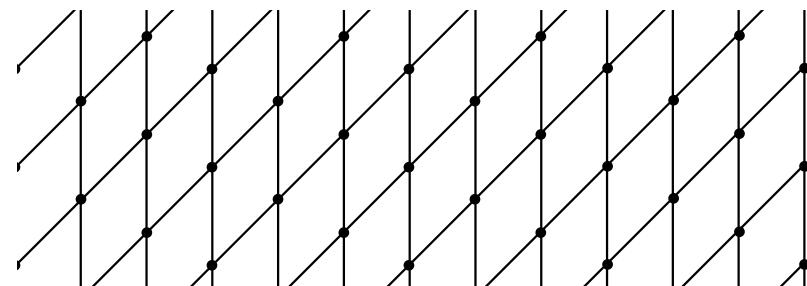
- ~~Return on Equity (Hou, Xue, & Zhang)~~.
- ~~Dividend Yield (Litzenberger & Ramaswamy)~~.
- RSI (Rosillo et al.)
- Momentum (Rosillo et al.)



3. Tracking & Adjustments

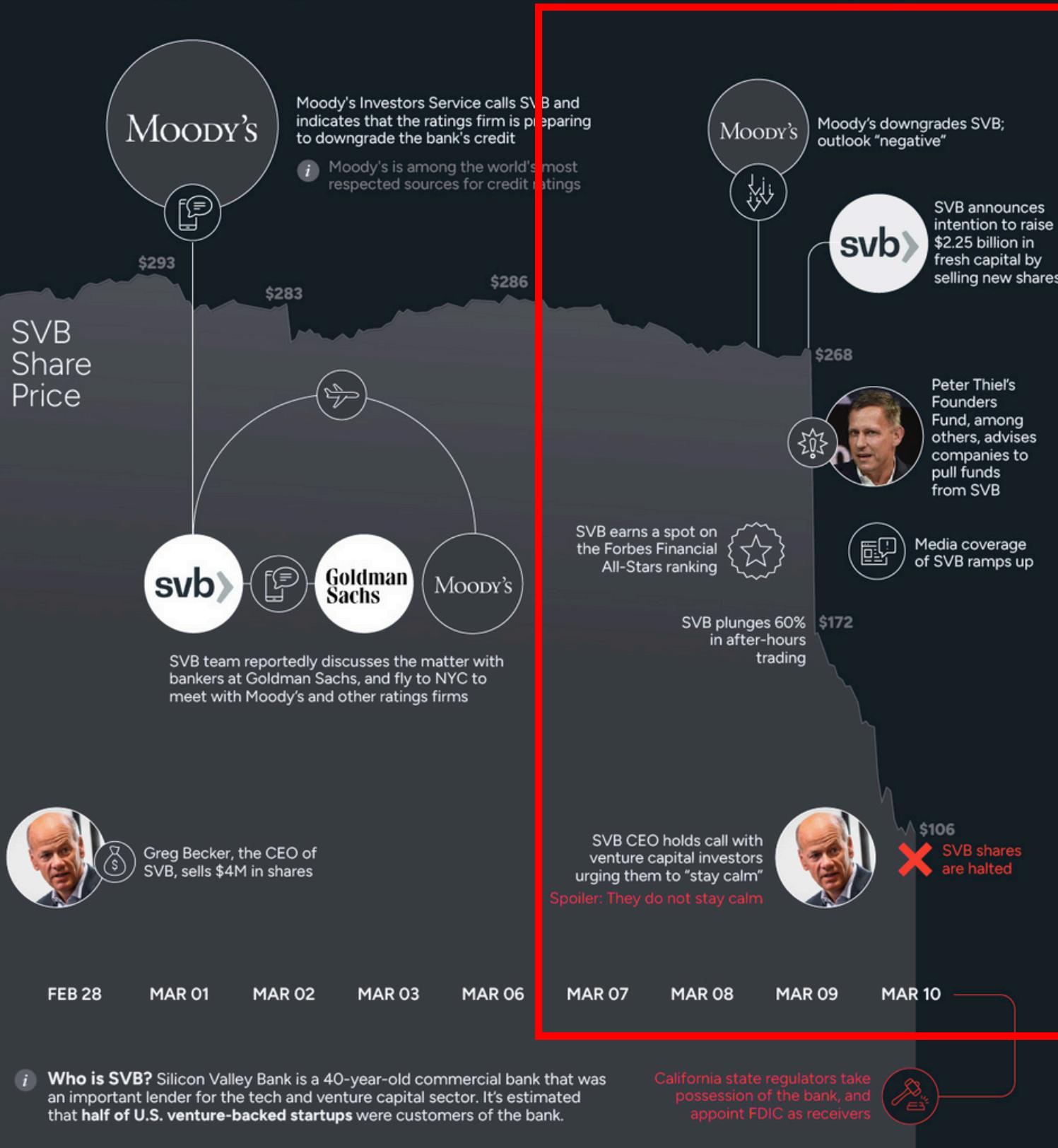
Why Shift from Monthly to Weekly Data?

- Monthly data **was too slow** to capture **rapid market movements**.
- **Weekly updates** ensure faster adaptation to market changes.
- Events like **Federal Reserve rate hikes, earnings reports, and market crashes demand** a more responsive strategy.



Silicon Valley Bank Collapse

SVB collapsed after widespread client withdrawals in what could become the second biggest bank failure in U.S. history. Below is a timeline of key events:



3. Tracking & Adjustments

How We Decide When to Sell & Buy

All stocks analyzed, total of 20 stocks processed.
Total 5 stocks generated sell signals.
Top 5 stocks with sell signals: ['ALPHABET INC', 'CHARLES SCHWAB', 'MICROSOFT', 'PROCTER & GAMBLE', 'WESTERN DIGITAL CORP']

Sell-Signal & Investment Decision Process

- Identified stocks with RSI > 70 (overbought) and negative momentum
- Stocks with Sharpe Ratio < 1 flagged for review

Enhanced Weekly Stock Selection

- Random Forest retrained weekly with new market data.
- Additional technical indicators: RSI, Momentum, Sharpe Ratio

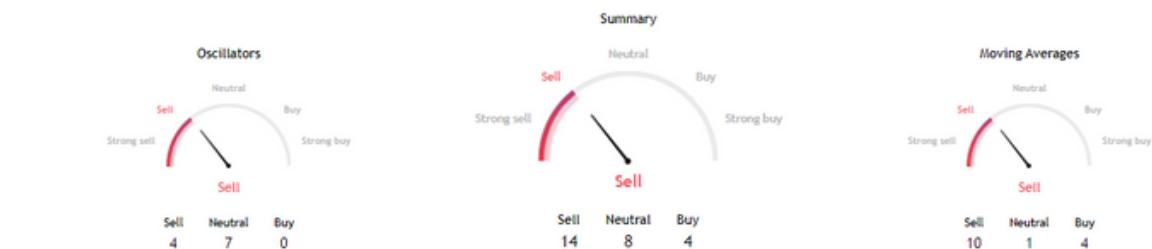
```
# Analyze top and bottom 20 stocks
def analyze_top_bottom(y_true, y_pred, data, name): 2 usages
    data = data.copy()
    data['Actual'] = y_true
    data['Prediction'] = y_pred
    data['Error'] = abs(data['Actual'] - data['Prediction'])

    top_20 = data.nlargest(40, 'Prediction')
    bottom_20 = data.nsmallest(20, 'Prediction')
```

Test Top 20 Stocks:				
	Company	Actual	Prediction	Error
479	WALMART INC	6.599232e+05	2.832266e+06	2.172343e+06
325	MONSTER BEVERAGE	4.416951e+04	2.800435e+06	1.616516e+06
231	HOME DEPOT, INC.	1.919024e+06	2.773143e+06	8.541185e+05
379	PROGRESSIVE OHIO	9.483029e+05	2.764968e+06	1.816633e+06
355	ORACLE	3.147816e+05	2.762595e+06	2.4477814e+06
442	TEXAS PACIFIC LAND	8.282691e+05	2.750898e+06	1.921828e+06
75	BROWN & BROWN	8.489468e+05	2.748455e+06	1.899508e+06
186	CINCINNATI FINL.	7.222382e+04	1.689825e+06	1.617601e+06
398	ROCKWELL AUTOMATION	1.359608e+05	1.685748e+06	1.547788e+06
51	AUTOPZONE INC	1.710318e+05	1.679518e+06	1.588486e+06
419	SOUTHWEST AIRLINES	3.149884e+05	1.154699e+06	8.397103e+05
425	STRYKER CORPORATION	5.585127e+05	1.081959e+06	5.314400e+05
8	AFLAC	6.141542e+05	9.731600e+05	3.590085e+05
54	AXON ENTERPRISE INC	8.136621e+04	9.406784e+05	8.593122e+05
440	TESLA INC	1.842505e+04	8.531191e+05	8.344940e+05
366	PENTAIR PLC	2.053293e+05	6.908524e+05	4.855221e+05
22	AMAZON.COM INC	2.028023e+05	4.431536e+05	2.409513e+05
346	NVIDIA CORPORATION	3.432730e+05	4.351873e+05	9.191435e+04
404	S&P GLOBAL INC	2.014281e+05	4.014317e+05	2.000035e+05
21	ALTRIA GROUP INC	2.028680e+05	3.994591e+05	1.965911e+05

Additional Checks for Confirmation

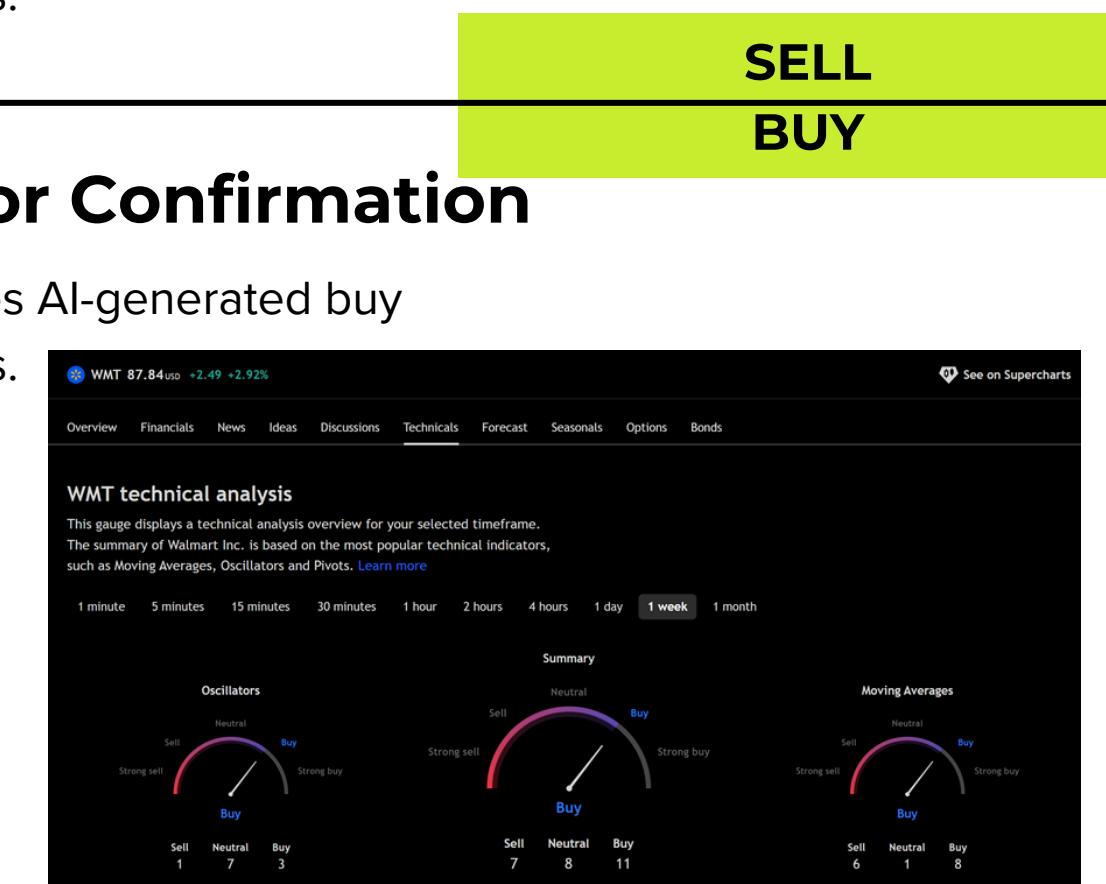
- TradingView Validation: Ensures AI-generated sell signals align with market trends.

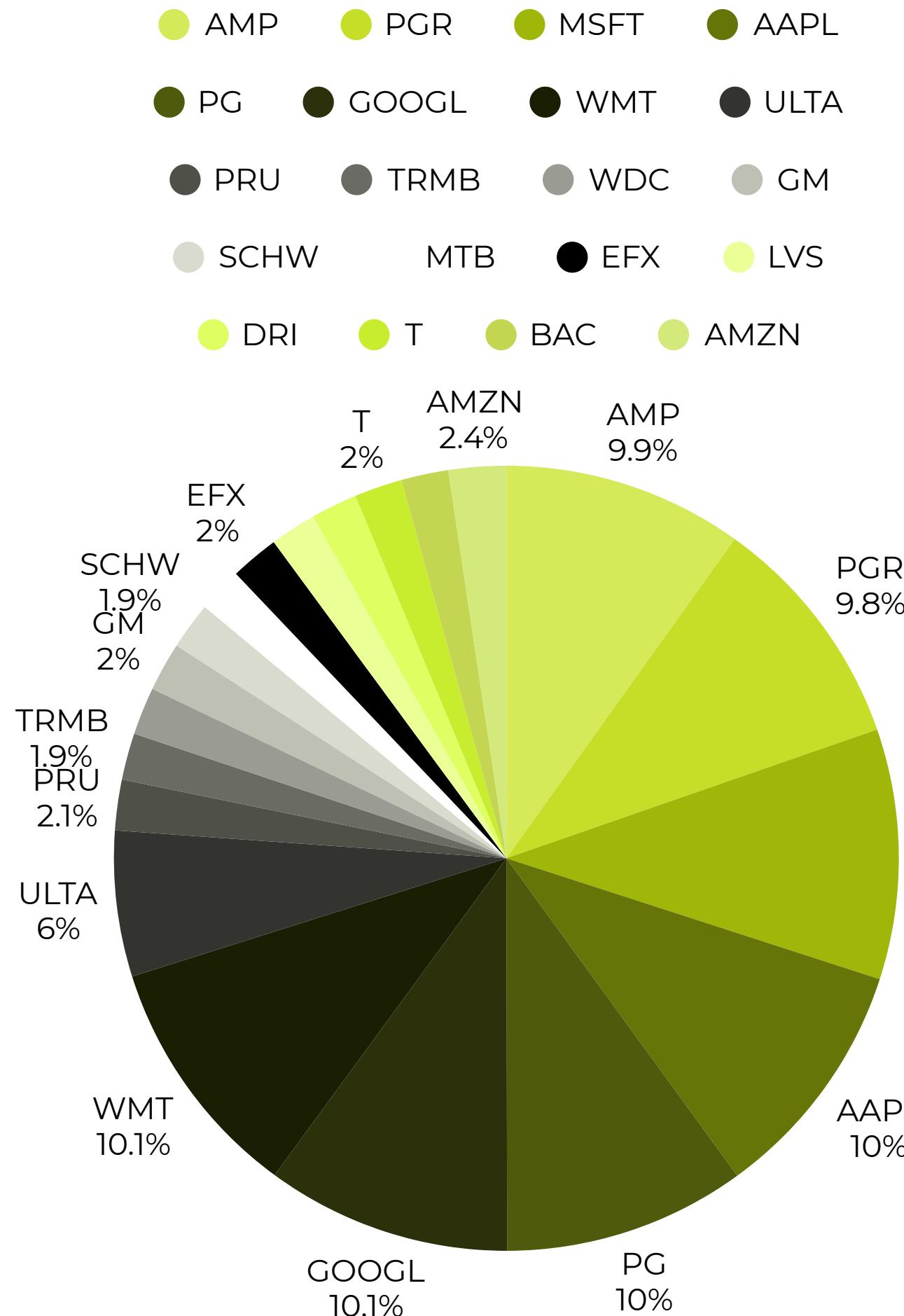


SELL
BUY

Additional Checks for Confirmation

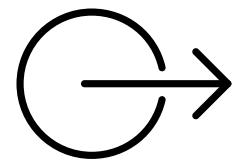
- TradingView Validation: Ensures AI-generated buy signals align with market trends.





3. Tracking & Adjustments

Adapting Stock Allocations



- **Rebalancing Based on Sell Transactions** – Only stocks involved in buy/sell decisions are adjusted, rather than a full Markowitz re-optimization.
 - **Sharpe Ratio-Based Weight Adjustments** – New stock weights are first determined by optimization, then rescaled proportionally to fit the total reinvestment budget while maintaining a 2% - 20% range.
 - **Budget Scaling** – The reinvestment budget changes weekly based on the total value of stocks sold, and new stock allocations are scaled accordingly to maintain portfolio balance.

```
daily_returns = price_data.pct_change().dropna()

annual_returns = daily_returns.mean() * 252 # 252 iş günü
cov_matrix = daily_returns.cov() * 252

# Risk-free rate (örnek: %2 yıllık faiz)
risk_free_rate = 0.02

def portfolio_metrics(weights, mean_returns, cov_matrix): 2 usages
    portfolio_return = np.dot(weights, mean_returns)
    portfolio_volatility = np.sqrt(np.dot(weights.T, np.dot(cov_matrix, weights)))
    return portfolio_return, portfolio_volatility

def negative_sharpe_ratio(weights, mean_returns, cov_matrix, risk_free_rate):
    p_return, p_volatility = portfolio_metrics(weights, mean_returns, cov_matrix)
    sharpe_ratio = (p_return - risk_free_rate) / p_volatility
    return -sharpe_ratio

def constraint_sum(weights): 1 usage
    return np.sum(weights) - 1
```

```
latest_prices = price_data.iloc[-1]

budget = 29544
portfolio_allocation = pd.DataFrame({
    'Company': price_data.columns,
    'Weight': np.round(optimal_weights, decimals: 4),
    'Latest Price': latest_prices,
})
portfolio_allocation['Allocation ($)'] = np.round(portfolio_allocation['Weight'] * budget, decimals: 2)
portfolio_allocation['Lots'] = (portfolio_allocation['Allocation ($)'] / portfolio_allocation['Latest Price'])

print("Optimal Portfolio Allocation:")
print(portfolio_allocation.sort_values(by="Weight", ascending=False))

print(f"\nPortfolio Expected Annual Return: {opt_return:.4f}")
print(f"Portfolio Volatility: {opt_volatility:.4f}")
print(f"Portfolio Sharpe Ratio: {opt_sharpe:.4f}")

print("\nPortfolio Allocation Based on $100,000 Budget and Lot Calculation:")
print(portfolio_allocation.sort_values(by="Weight", ascending=False))
```

4. Sentiment Analysis

Why We Integrated Sentiment Analysis?

US stock market loses \$4 trillion in value as Trump plows ahead on tariffs

By Lewis Krauskopf and Saqib Iqbal Ahmed
March 11, 2025 2:10 AM GMT+3 · Updated 6 days ago



Monday's major selloff followed a weekend interview with President Donald Trump in which he would not rule out the possibility of a U.S. recession.

Summary Companies

• S&P 500 down over 8% from Feb 19 all-time high

5 billionaires at Trump's swearing-in see over \$200 billion vanish in weeks

The start of Donald Trump's second term has been brutal for some of the world's richest billionaires, including those present at his swearing-in ceremony.



DeepSeek buzz puts tech stocks on track for \$1.2 trillion drop

Bloomberg · Last Updated: Jan 28, 2025, 12:00:00 AM IST

Synopsis

DeepSeek, a Chinese AI startup, has unveiled a cost-effective AI model that runs on less advanced chips, challenging the dominance of major tech players like Nvidia. This new development has caused a significant drop in global tech stocks, raising doubts about the high valuations of AI-driven companies.



Chinese artificial intelligence startup DeepSeek's latest AI model sparked a \$1 trillion rout in US and European technology stocks, as investors questioned bloated valuations for some of America's biggest companies.

Limitations of Price-Based Models

- Missed key market events, leading to delayed reactions.
- High volatility in S&P 500 stocks due to political shifts.

Market Shocks Observed

- Trump Administration Transition → Increased uncertainty.
- DeepSeek Scandal → Rapid stock price fluctuations.

Sentiment Analysis Integration

- Enabled real-time adjustments before price-based indicators reacted.
- Captured political & foreign policy influences on stock movements.

4. Sentiment Analysis

How We Integrated Sentiment Analysis



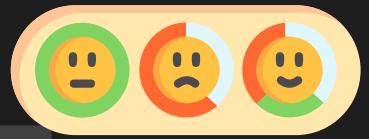
- **Integrated Financial News Sentiment Analysis** – Fetched news articles via RSS from Yahoo Finance and analyzed sentiment using FinBERT (ProsusAI/FinBERT).
- **Compared Market Behavior Before & After Sentiment-Driven Decisions** – Evaluated how stock movements correlated with sentiment scores derived from aggregated financial news over the past week.
- **Market Sentiment Provides Early Warning Signals** – Identifies potential trends before they reflect in stock prices, helping in proactive decision-making.

```
# 3. Fetch RSS feed & run sentiment analysis on news articles
rss_url = f"https://finance.yahoo.com/rss/headline?s={ticker}"
with st.spinner("Fetching and analyzing news articles..."):
    feed = feedparser.parse(rss_url)
    articles_list = []
    total_score = 0
    num_articles = 0
    start_time = time.time()

    for entry in feed.entries:
        # Filter based on keyword in title or summary
        if keyword.lower() not in entry.summary.lower() and keyword.lower() not in entry.title.lower():
            continue

        sentiment_label, sentiment_score = analyze_sentiment(entry.summary)

        # Map sentiment label to one of positive/negative/neutral
        if "pos" in sentiment_label.lower():
            mapped_label = "positive"
            total_score += sentiment_score
            num_articles += 1
        elif "neg" in sentiment_label.lower():
            mapped_label = "negative"
```



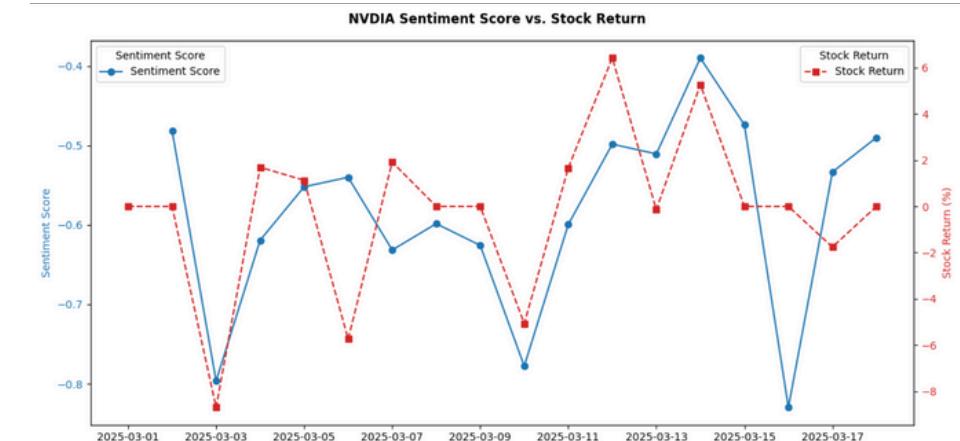
```
# -----
# Alpha Vantage & Model Config
# -----
ALPHA_VANTAGE_API_KEYS = [
    "1JBBBFINKKCNWNQO.",
    "EJU22Q5IIIASLS3V.",
]
ALPHA_VANTAGE_API_URL = 'https://www.alphavantage.co/query'
MODEL_NAME = "ProsusAI/finbert"
```

```
53 def get_stock_prices(tickers):
54     prices = {}
55     for i, ticker in enumerate(tickers):
56         try:
57             stock = yf.download(ticker, period="1d")
58             if not stock.empty:
59                 prices[ticker] = stock['Close'].iloc[-1] # Here we take float instead of Series
60             except Exception as e:
61                 print(f"Error fetching {ticker}: {e}")
62
63             # Let's wait every 5 requests to avoid hitting the API limit
64             if i % 5 == 0:
65                 time.sleep(2) # 2 second waiting
66
67     return prices
```

4. Sentiment Analysis

Market Sentiment as a Decision Factor

- FinBERT-Based Sentiment Integration** – Financial news sentiment from Yahoo Finance RSS is classified as positive, neutral, or negative using FinBERT.
- Stronger Sentiment Influence** – Sentiment signals now have twice the weight of RSI & Momentum for better market psychology adaptation.
- Prioritized Real-Time Sentiment & Momentum** – Focused on sentiment-driven decisions instead of historical trend indicators.
- Aggregated Sentiment Score Used in Trading Decisions** – The latest available news sentiment is aggregated to dynamically influence buy/sell signals.



Pearson Correlation Coefficient: 0.5467 (p-value: 0.0232)

```
# Map sentiment label to one of positive/negative/neutral
if "pos" in sentiment_label.lower():
    mapped_label = "positive"
    total_score += sentiment_score
    num_articles += 1
elif "neg" in sentiment_label.lower():
    mapped_label = "negative"
    total_score -= sentiment_score
    num_articles += 1
else:
    mapped_label = "neutral"
```

```
sentiment_weight = 2
if sentiment_score > 0.5:
    buy_signals += sentiment_weight
elif sentiment_score < -0.5:
    sell_signals += sentiment_weight

if buy_signals > sell_signals:
    return "BUY"
elif sell_signals > buy_signals:
    return "SELL"
else:
    return "HOLD"
```

Positive	Increases buy signal likelihood by reinforcing momentum-based signals.
Negative	Strengthens sell signals or prevents new investments in weak-performing stocks.
Neutral	Keeps decision unchanged unless technical indicators strongly suggest otherwise.

4. Sentiment Analysis

Multi-Layered Decision Process

```
def get_sp500_tickers():
    """Fetches a static list of S&P 500 tickers."""
    tickers = [
        'ABT', 'AMP', 'T', 'AZO', 'AXON', 'BAC', 'BRO', 'CZR', 'SCHW', 'DTE',
        'GNRC', 'HD', 'MNST', 'NVDA', 'OKE', 'PNR', 'PGR', 'SYK', 'TRMB', 'WMT',
        'TSLA', 'ALB', 'WYNN', 'PLTR', 'TRGP', 'COP', 'HES', 'PAYC', 'KMX',
        'MOS', 'UAL', 'ON', 'CF', 'SPG', 'VLO', 'RCL.GF', 'BKR', 'DELL', 'TPR',
        'SYF', 'LW', 'AIG', 'FANG', 'DFS', 'WDC', 'AMD', 'EOG', 'BA', 'DAL',
        'ANET', 'FCX', 'MPC', 'VTR', 'AMZN', 'PYPL', 'EQT'
    ]
    return tickers
```

Random Forest Prediction

- Selects top-performing stocks based on expected weekly returns using a trained model with optimized features.

RSI & Momentum Validation

- Confirms trend direction & identifies overbought/oversold conditions to refine stock selection.

Sharpe Ratio Assessment

- Ensures selected stocks provide a strong risk-adjusted return, filtering out volatile or weak candidates.

```
if sharpe > 1:
    buy_signals += 1
elif sharpe < 0:
    sell_signals += 1
```

Sentiment Adjustment

- Market sentiment is integrated to reinforce buy signals or prevent investments in stocks with negative sentiment.

```
if rsi > 30 and prev_rsi <= 30:
    buy_signals += 1

elif rsi > 70 and prev_rsi <= 70:
    sell_signals += 1

if momentum > 0:
    buy_signals += 1
elif momentum < 0:
    sell_signals += 1
```

```
sentiment_weight = 2
if sentiment_score > 0.5:
    buy_signals += sentiment_weight
elif sentiment_score < -0.5:
    sell_signals += sentiment_weight

if buy_signals > sell_signals:
    return "BUY"
elif sell_signals > buy_signals:
    return "SELL"
else:
    return "HOLD"
```

4. Sentiment Analysis

Web Platform Implementation

Daily Stock Analysis - InvestingAI-6

Live Stock Prices

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Select the stock

Choose ticker from S&P 500 list

Select Stock Ticker: NVDA

Enter Keyword for Filtering Articles: nvda

Export Results to Excel

Analyze

Results

Intraday Stock Chart for NVDA

Real-Time Stock Price for NVDA

Price (USD)

Time

12:00 Mar 17, 2025

116 117 118 119 120 121

NVDA Metrics

RSI: 47.47

Momentum: -0.61

Sharpe Ratio: -0.57

Overall Sentiment: Negative

Aggregated Score: -1.91

Sentiment Distribution for NVDA

Sentiment Distribution for NVDA

Sentiment	Score
Positive	0.76
Neutral	0.76
Negative	0.97

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↳ Positive (0.93)
[Read Full Article](#)

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↳ Neutral (0.92)
[Read Full Article](#)

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↳ Neutral (0.54)
[Read Full Article](#)

Investment Decision

Investment Decision: SELL

4. Sentiment Analysis

Web Platform Implementation

Daily Stock Analysis - InvestingAI-6

Live Stock Prices

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Select the stock

Choose ticker from S&P 500 list

Select Stock Ticker

NVDA

Enter Keyword for Filtering Articles:

nvda

Export Results to Excel

Analyze

Live Stock Prices – Continuously updated stock price ticker.

Results

Intraday Stock Chart for NVDA

Real-Time Stock Price for NVDA

Price (USD)

121
120
119
118
117
116

12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00

Time

12:00 Mar 17, 2025

Momentum -0.61

Sharpe Ratio -0.57

RSI 47.47

Overall Sentiment: Negative

Aggregated Score: -1.91

Sentiment Distribution for NVDA

Positive (0.76)

Neutral (0.93)

Negative (0.92)

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Select the stock

Choose ticker from S&P 500 list

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NVDA

Enter Keyword for Filtering Articles

nvda

Export Results to Excel

Analyze

Intraday Stock Charts – Real-time visualization of price fluctuations.

Results

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Sentiment Distribution for NVDA

Positive: 1

Neutral: 6

Negative: 2

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Positive (0.93)
[Read Full Article](#)

Technical Analysis Tools – RSI, Momentum, and Sharpe Ratio for trend evaluation.

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Investment Decision

Investment Decision: SELL

4. Sentiment Analysis

Web Platform Implementation

Daily Stock Analysis - InvestingAI-6

Live Stock Prices

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12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00

Time

Momentum

-0.61

Sharpe Ratio

-0.57

Overall Sentiment: Negative

Aggregated Score: -1.91

Sentiment Analysis – AI-based classification of financial news as positive, neutral, or negative.

Deploy ::

Sentiment Distribution for NVDA



Positive Neutral Negative

Articles (11)

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↳ Positive (0.93)
[Read Full Article](#)

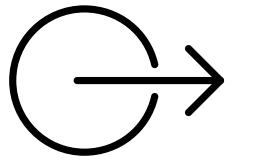
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Investment Decision

Investment Decision: SELL

4. Sentiment Analysis



Web Platform Implementation

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Select the stock

Choose ticker from S&P 500 list

Select Stock Ticker: NVDA

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Export Results to Excel

Analyze

Results

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Real-Time Stock Price for NVDA

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Momentum: -0.61

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Overall Sentiment: Negative

Aggregated Score: -1.91

Sentiment Distribution for NVDA

Positive: 1

Neutral: 6

Negative: 3

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[Read Full Article](#)

The Ultimate Guide to Nvidia
Published: Tue, 18 Mar 2025 08:54:00 +0000
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↳ Positive (0.93)
[Read Full Article](#)

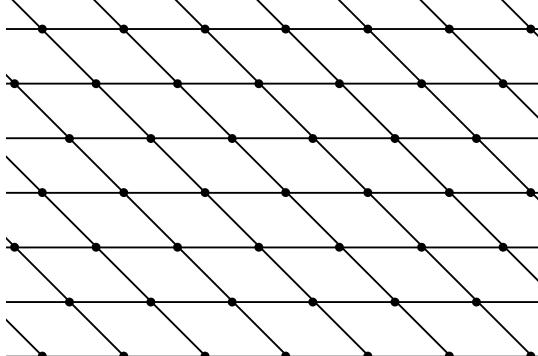
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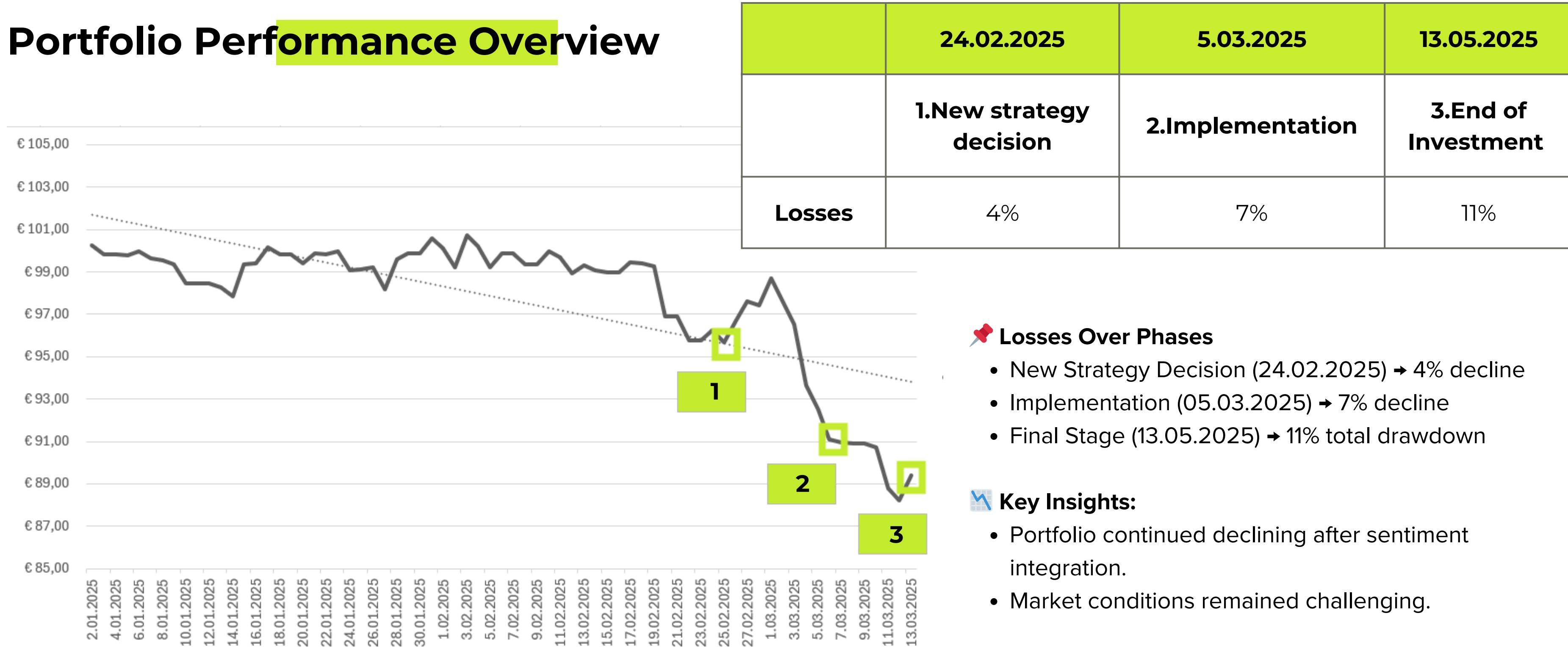
⚡ Investment Decision – BUY, SELL, or HOLD recommendations based on sentiment and technical indicators.

Investment Decision: **SELL**

5. Performance Review



Portfolio Performance Overview



5. Performance Review

Evaluating Our Strategy

5.03.2025	
Before Implementing Sentiment Analysis	
Simple Statistical Analysis	Results
Mean	-0,00153
Standart Deviation	0,008467
Skewness	-0,75817
Kurtosis	2,040609
Sharpe Ratio	-0,1807



Portfolio showed major decline with a 7% drop at the initial decision stage and poor statistics, while the S&P 500 also declined, indicating a similar benchmark trend.

- **Mean Return:** -0.0015 → Negative expected return
- **Standard Deviation:** 0.0084 → Moderate volatility
- **Skewness:** -0.7582 → Frequent extreme losses
- **Kurtosis:** 2.04 → Failed to capture market spikes
- **Sharpe Ratio:** -0.1807 → Poor risk-adjusted returns

5. Performance Review

After Implementing Sentiment Analysis

13.05.2025	
Final Results	
Simple Statistical Analysis	Results
Mean	-0,01611
Standart Deviation	0,119619
Skewness	-8,24163
Kurtosis	68,26774
Sharpe Ratio	-0,13469

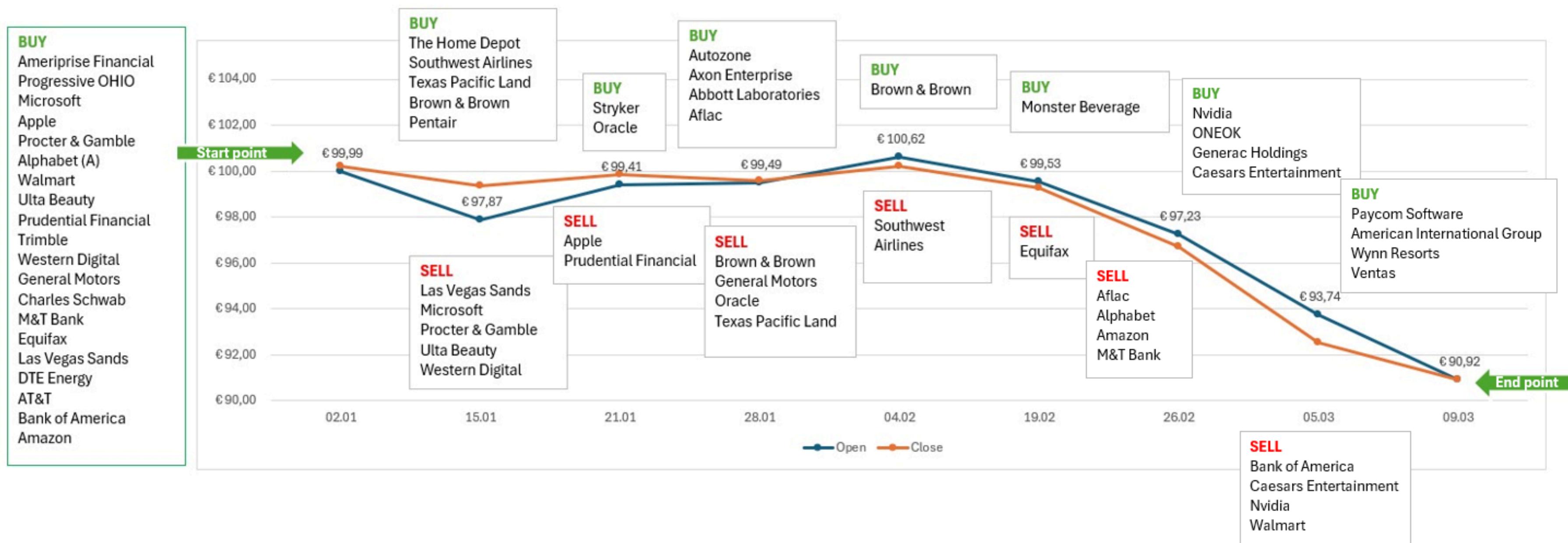


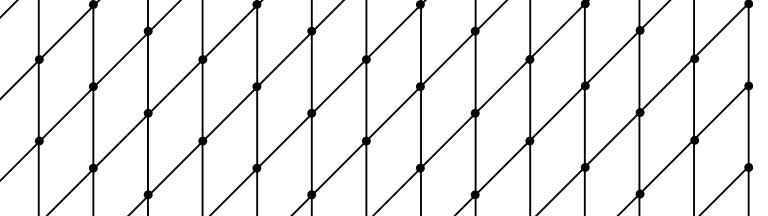
- **Mean Return:** -0.0161 → Declined further
- **Standard Deviation:** 0.1196 → Higher fluctuations, riskier portfolio
- **Skewness:** -8.2416 → Increased frequency of extreme losses
- **Kurtosis:** 68.27 → Significant sentiment-driven volatility
- **Sharpe Ratio:** -0.1347 → Slight improvement, but still negative

The strategy was only applied for one week, limiting observable impact. Further refinement is needed to assess long-term effectiveness.

5. Performance Review

Trading Overview





Thank You

For Your Attention

